Statement on Teaching Philosophy

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I witnessed great teaching personified while taking turbulent fluid mechanics, as my professor welcomed my questions, took interest in my research projects, and even sought advice from the university's teaching center in order to explain concepts more clearly. In particular, upon learning that my fluid mechanics background was not as strong as that of the other students, he worked to correct my misunderstandings and apply the concepts to my own work with innovative explanations. The experience influenced me practically and philosophically, allowing me to clarify a turbulent phenomenon in my research and also fostering my desire to understand my scholars and improve my curriculum to empower those I teach. As a result, I learned the best way to be an effective teacher is to adopt the posture of a learner. *I strive to be a student of my students and a student of pedagogy in order to enable my students to solve problems independently.*

Student of my students: Teaching from and synthesizing new information with their educational backgrounds

As a student of my students, I endeavor to understand my scholars' current knowledge foundations so that I can present them with contextualized information. This is particularly important in my role as a teacher with the organization Sigay Kauyagan at Mindanao State University in the Philippines. To give one example, I designed and taught a six-week mini-course on Octave/Matlab programming. At the beginning of the course, I spoke with the students about their previous experiences, and learned that most had no prior programming training and only basic math backgrounds. I therefore used simple practice exercises to bridge between the students' current understanding and the course material. For instance, to introduce arrays and matrices, I asked students to write out by hand the digits of their phone numbers in a grid. The students found this to be a straightforward and easy way to approach digital information storage, since they were already accustomed to working with their phone numbers. Later, to introduce computer graphing, I gave the students a small set of data and asked them to work in pairs to plot it by hand. Following this exercise, I presented some of the basic computer graphing functions and asked the student pairs to recreate their hand-drawn plots digitally. I have used this strategy of tailoring explanations and information in a variety of educational settings, such as the classroom and laboratory, and with students from a wide range of educational backgrounds. In the example above, I modified my teaching to fill preliminary knowledge gaps; in other instances, I have adapted material to engage learners who began with advanced understanding. In all cases, taking time initially to gauge students' background understanding is critical in making instruction challenging and exciting.

Being a student of my students involves not only being aware of and initiating instruction at their background knowledge level, but also providing opportunities for them to synthesize their outside understanding with new course concepts. I like to approach this by providing practical, thought-provoking demonstrations in class. In one case, when reviewing the first law of thermodynamics in a physics tutorial at Mindanao State University, I lit a match, let it burn out, and then asked the students to identify for me the energy forms and transfers that occurred. Although all of the students had lit matches dozens of times in their day-to-day lives, probably few had paused to consider the process from a thermodynamic perspective. To conclude the exercise, I explained to the students that the match's chemical energy had ultimately dissipated primarily by heating the atmosphere, and I briefly touched on how combustion contributes to climate change. I could tell from the students' nods and smiles that the demonstration had caused them to think, not just about thermodynamics, but also about energy use and its wider consequences. Being a student of my students made me aware of their prior understanding and experience. In turn, this allowed me to guide them to integrate new knowledge into their conceptual frameworks.

Student of pedagogy: Continuously improving my teaching by iterating and researching

As a student of pedagogy, I adapt and advance my course designs to increase student engagement and improve learning outcomes. A prime example comes from my cellular biology

review sessions at Mindanao State University. In my first section, I quizzed students verbally about the parts of cells and clarified their misunderstandings. However, upon reflecting afterward, I realized that this approach offered few opportunities for students to repeat and interact with the concepts. Therefore, in my second section, I developed a relatable analogy between the parts of the cell and a local discount grocery store [1]. To begin, I asked the students to describe to me their shopping experiences at this store. I then passed out a fill-in-the-blank worksheet that drew the appropriate parallels (for instance, the doors of the store were the plasma membrane and the store manager was the cell nucleus), and I led them through it using a series of questions about their shopping experiences and their knowledge about cells. Finally, to check their understanding, I drew a comparison chart on the board and asked the class to cooperate together to complete the chart from memory. The students remained eagerly engaged throughout the entire activity, and one even said, "*This is exciting!*" By becoming a student of pedagogy, I realized the shortcomings in my first strategy and adopted a new approach that resonated well with my class.

In addition to improving my technique based on personal experience, I enjoy reading about and trying new pedagogical methods. For instance, I spent time searching for alternatives to the conventional lecture strategy in which students would actively engage in learning. This led me to experiment with the jigsaw exercise [2] during a heat transfer review session at Mindanao State University. With students in groups of three, I asked one member per group to examine their class notes about conduction, the second to review convection, and the third to study radiation. I then gave the group members time to teach one another about their respective heat transfer methods, while I circulated to listen and offer clarifications. It thrilled me to see the students using animated language and expressions to explain the concepts. Finally, I asked one group to approach the blackboard and review the concepts for the entire class, with the constraint that each member must demonstrate a heat transfer mode different from that which they had studied individually. In this way, students each learned a piece of the heat transfer puzzle, and then came together to share and create the complete picture. This new teaching approach allowed the students to be responsible for their learning, and also provided me with real-time feedback about their understanding.

Solving problems independently: Asking questions

One of my chief aims in teaching with the aforementioned methods is to move past simply presenting concepts, toward equipping students to engage and interact with information independently. My goal in doing so is to help students grow into resourceful and empowered professionals well beyond my classroom. By teaching my students starting from, and synthesizing new information with, their background understanding, I build a foundation upon which my scholars can solve problems on their own. Moreover, by continuously improving my curriculum through iteration and research, I develop the methodology through which I can empower them to tackle challenges. As a graduate teaching assistant for kinetics at Stanford University, I used questions and peer teaching as tools to move students toward self-guided analysis [3-6]. I also pushed them to pinpoint the aspects of the material that they did not understand and urged them to ask specific questions that would address those trouble spots. Some students were frustrated at first with my unwillingness to give easy and direct answers. However, by the end of the course, the students indicated in their evaluations that they appreciated my approach. Wrote one student, "*… in my opinion your strongest teaching quality is getting each student to explain concepts to themselves/to the other students*." Another said, "*… by asking me questions, I was able to think more clearly about the concepts.*" My hope is that the question/answer-based thought patterns that I demonstrate will continue to unlock solutions for my students long after they leave my classroom.

I still remember the impact that my turbulent fluid mechanics professor had on me. By taking interest in my work and creatively clarifying difficult concepts, he enabled me to experience success. I intend to approach my own teaching as a student of my students so that I can establish and build into a foundation of core competency. I also desire to remain a student of pedagogy in order to continuously improve and refresh my curriculum. *Ultimately, I believe that by taking the posture of a student in these ways, I will be able to equip my students to solve problems independently.*

Teaching areas

- Combustion
- Compressible flow
- Computer methods in Engineering (Matlab/Octave)
- Energy systems
- Fluid mechanics
- Heat and mass transfer
- Mechanical and product design methodology
- Physical gas dynamics
- Reaction kinetics
- Spectroscopy
- Thermodynamics

References

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